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## FINAL TECHNICAL REPORT

to the

Office of Naval Research

Contract N00014-89-J-1929

FSU Budget 1368-609-27

*"Hydrography of the East China Sea"*

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Y. Hsueh, Principal Investigator  
Department of Oceanography  
Florida State University  
Tallahassee, Florida 32306  
904/644-6700

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## Summary of Results

The project goal is to identify primary topics of research in the East China Sea, a marginal sea pierced by the Kuroshio. The intrusion of the Kuroshio across the continental shelf break northeast of Taiwan is established as the one topic that is of primary importance and could lead to a significant research effort. This topic is pursued and two papers have already resulted from the effort. The following are abstracts:

Hsueh, Y., J. Wang and C-S Chern, *The intrusion of the Kuroshio across the Continental Shelf Northeast of Taiwan*, J. Geophys. Res., in press

Hydrographic observations in an area immediately northeast of Taiwan in April 1989 indicate an on-shelf intrusion of Kuroshio water across a sharply curved continental shelf break. It appears that a part of the Kuroshio on the cyclonic side overran the shelf break and penetrated northward as a shallow surface current. The remainder of the Kuroshio presumably affected by the shoaling topography, largely turned and ran along the shelf break to the northeast. Between the two, the flow was weak and disorganized. Conservation of potential vorticity and constancy of the Bernoulli function in an analytical, reduced-gravity model of the incidence of a baroclinic current upon a step shelf lead to an on-shelf flow field that is compatible to the observed hydrographic distributions. In particular, the integrated balance of along-step momentum yields an expression of the angle of intrusion in terms of the incidence angle and of the ratio of step depth to the depth of the upper layer of the ocean. In addition, the transport of the intrusion is shown to be equal to the product of the depth ratio squared and the incident transport. Calculations for the condition of the April survey yield results in agreement with the observation.

Hsueh, Y., C-S Chern and J. Wang, *The blocking of the Kuroshio by the Continental Shelf Northeast of Taiwan*, J. Geophys. Res., submitted.

Hydrographic observations in August 1991 in an area immediately northeast of Taiwan, where, in April 1989, an on-shelf intrusion of the Kuroshio was observed, indicate a blocking of the Kuroshio at the continental shelf break. It appears that the Kuroshio approaches the shelf break as a near-bottom current and is deflected. The deflection apparently gives rise to a countercurrent along the shelf break which was observed by a buoy-mounted Acoustic Doppler Current Profiler (ADCP) deployed

within a month of the hydrographic survey. The on-shelf hydrographic distribution accompanying the deflection exhibits a field of near-bottom eddies, dominated by a particularly well-organized large pool downstream and to the right of the approaching Kuroshio, but well-separated from the Kuroshio. The hydrographic properties of the pool are similar to those of the uplifted Kuroshio subsurface water observed in April 1989, suggesting that it may be the remnant of the Kuroshio subsurface water that had intruded during the previous winter.

A theory of the blocking is put forth in terms of the approach of a bottom current toward a step rise of the bottom in a two-layered, reduced-gravity ocean model in which the thickness of the current exceeds the rise in topography. The theory predicts a complete blocking that features a flow deflection in front of the step and the presence, on the step, of a preexisting region of high baroclinic pressure, similar to the observation. The theory also predicts approximately correctly the track of the isotherm that bounds the large pool on the side facing the on-rushing Kuroshio.

The Florida State University Office of Research and Contracts and Grants will be submitting under separate cover a Final Financial Status Report and Inventions Report.

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